

Spectroscopy of Isolated Prebiotic Nucleobases

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We use multiphoton ionization and double resonance spectroscopy to study the excited state dynamics of biologically relevant molecules as well as prebiotic nucleobases, isolated in the gas phase. Molecules that are biologically relevant to life today tend to exhibit short excited state lifetimes compared to similar but non-biologically relevant analogs. The mechanism is internal conversion, which may help protect the biologically active molecules from UV damage. This process is governed by conical intersections that depend very strongly on molecular structure. Therefore we have studied purines and pyrimidines with systematic variations of structure, including substitutions, tautomeric forms, and cluster structures that represent different base pair binding motifs. These structural variations also include possible alternate base pairs that may shed light on prebiotic chemistry. With this in mind we have begun to probe the ultrafast dynamics of molecules that exhibit very short excited states and search for evidence of internal conversions.